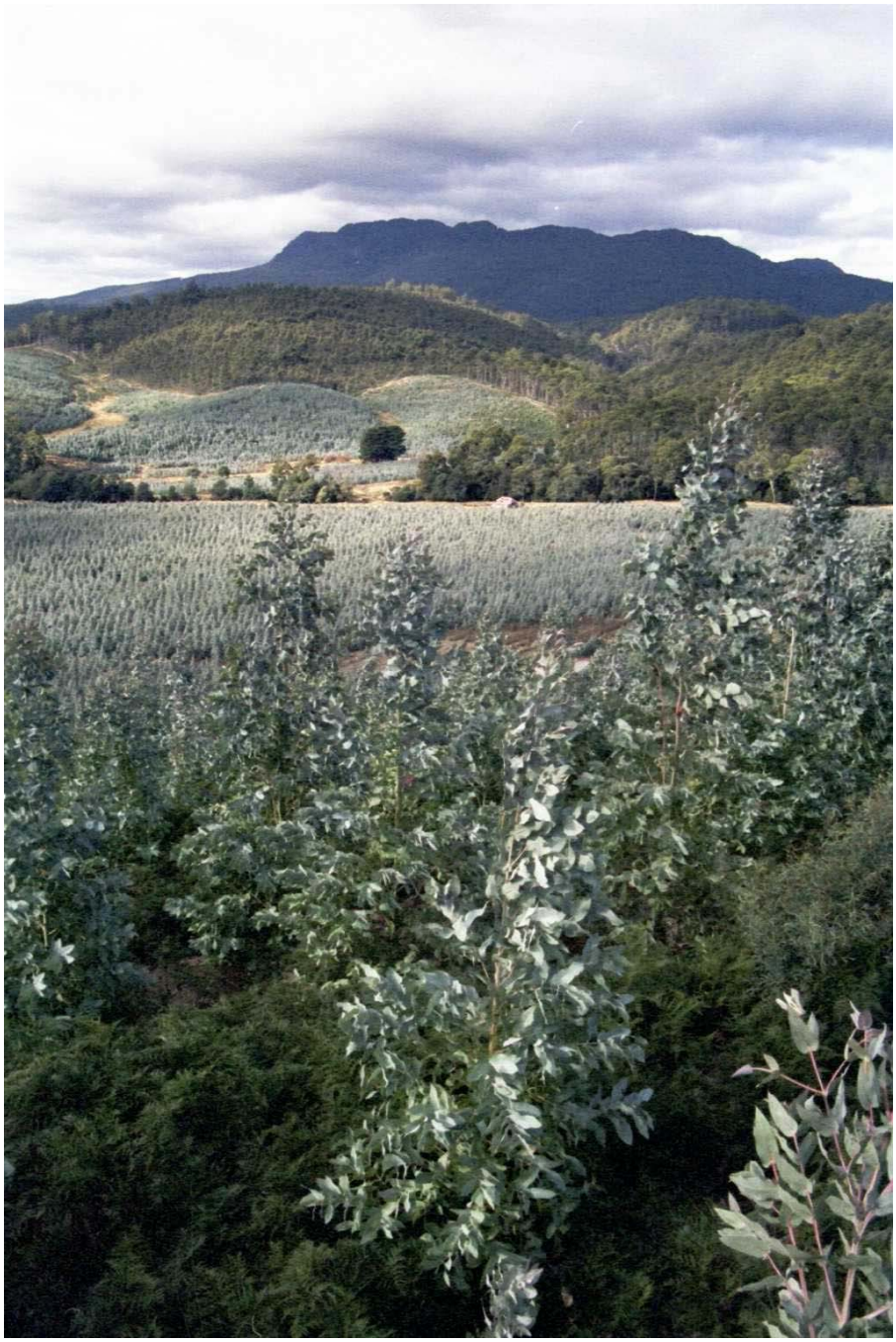

Exotic *Eucalyptus nitens* plantations established among native eucalypt populations in north-east Tasmania. Ben Lomond National Park is in the background.

Gene flow from introduced *Eucalyptus* plantations into native eucalypt species

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B.Sc. (Hons)

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Declarations

This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the thesis, and to the best of my knowledge and belief no material previously published or written by another person except where due acknowledgement is made in the text of the thesis.

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Abstract

There has been a massive expansion of *Eucalyptus* plantations in Australia in the last decade. As most eucalypt species are native to Australia, this has raised concerns about genetic pollution of native species gene pools. To assess the risk of genetic pollution, five key aspects of gene flow from *E. nitens* plantations in Tasmania were studied. Firstly, the pattern of pollen dispersal from plantations into native *E. ovata* forests was examined at three sites. The frequency of F_1 hybrids among 119 000 progeny, grown from open-pollinated seed collected from *E. ovata* trees at varying distances from *E. nitens* plantations, was determined. A leptokurtic pattern of pollen flow was evident, with the mean level of hybridisation at the plantation boundaries (0-100 m) being 14%, dropping to 1% by 200-300 m and continuing at this level to the extent of the studied areas (max. 1600 m). Secondly, the first exotic *E. ovata* x *nitens* F_1 hybrids actually established in the wild were discovered and verified using morphological and allozyme analyses. Thirdly, field trials were established to assess the fitness of the exotic *E. ovata* x *nitens* F_1 hybrids in the wild. The hybrids displayed poorer early-age performance relative to their pure *E. ovata* half-sibs. However, many were still alive and growing successfully two years after planting. Fourthly, surveys of flowering time were conducted on native *Symphyomyrtus* species, which were potentially at risk of gene flow from plantations. This was combined with a spatial analysis of the proximity of eucalypt plantations to each native species, and used to produce an overall assessment of the potential for exotic hybridisation and gene flow. These results indicated that at least eight of the 16 *Symphyomyrtus* species in Tasmania appear to have significant potential

for pollination by *E. nitens*, and will need further study. Finally, the crossability of *E. nitens* pollen on native female *Symphyomyrtus* species was assessed using artificial pollination techniques. A number of species did not produce hybrids with *E. nitens*, indicating that post-mating barriers may be acting to prevent hybridisation. Overall results suggest that the main risk of genetic pollution in Tasmania is limited to a few species. Of those species, the ability of first and later generation hybrids to survive to reproductive maturity and backcross with native populations, allowing the introgression of exotic genes, is yet to be assessed.

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Firstly, I would like to extend a huge thanks to my supervisors, Brad Potts and René Vaillancourt for their exceptional support, patience and knowledge throughout the project.

Secondly, I would like to thank the Australian Research Council and the Cooperative Research Centre for Sustainable Production Forestry for financial and in-kind research support. The support of several forest companies is also greatly appreciated. Gunns Ltd supplied *Eucalyptus nitens* seed and pollen, access to properties, provision of trial sites, information concerning plantations, and in-kind field support. Forestry Tasmania provided valuable information and field sites for the establishment of trials, and Norske Skog Paper Mills (Australia) Limited provided access to plantation sites. I would also like to thank Wayne Tibbits for help starting the project and for providing the *E. nitens* x *cordata* F_1 hybrid pollen.

Thirdly, and undoubtedly, a huge thankyou goes to my parents and friends for all their support and constancy, I really could not have done it with out you. Thankyou.

Table of contents

Format of thesis chapters

The experimental chapters of this thesis (Chapters 2 to 6) have been written in the format of published scientific journal articles. Because Chapters 2 and 3 have been, or are in the process of being published (see following page), sections of their text are repeated in the general introduction of the thesis. For Chapters 4, 5 and 6 however, broad introductory text into the general area of research has not been included, to prevent excessive repetition. Despite this, some themes and text are still repeated within these chapters. Abstracts, acknowledgements and lists of references have been combined into single versions for the whole document. Figures and tables have also been re-numbered.

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Potts BM, Barbour RC, Hingston AB, Vaillancourt RE (2003) Turner Review No. 6. Genetic pollution of native eucalypt gene pools - identifying the risks. *Australian Journal of Botany* **51**, 1-25. (see General appendix)

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Barbour RC (2003) Gene flow between introduced and native *Eucalyptus*. Oral presentation for the CRC-SPF board, CSIRO Forestry and Forest Products building, Hobart, Australia.

Barbour RC (2003) Gene flow between introduced and native *Eucalyptus*. Concluding PhD seminar, School of Plant Science, University of Tasmania, Hobart, Australia. (see CD pouch on inside of back cover)